

PROCEEDINGS
 OF THE
 BIOLOGICAL SOCIETY OF WASHINGTON

SOME RECENT COLLECTIONS OF *PLETHODON*
 FROM VIRGINIA WITH THE DESCRIPTION
 OF A NEW FORM

BY ARNOLD B. GROBMAN

Department of Biology, University of Florida

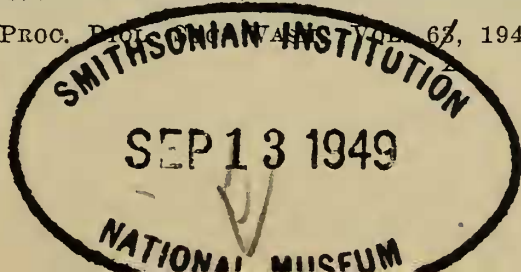
Recent collections by a number of herpetologists necessitate an extension of the arrangement of certain of the plethodons in Virginia as given in the most recent of the general reviews (Bishop, 1943; Grobman, 1944). The ranges of *Plethodon richmondi* and *P. wehrlei* are extended in Virginia and a new form of the flecked plethodons (*Welleri* Group) is described.

Messrs. Clifford H. Pope, Harry G. M. Jopson, Hubert I. Kleinpeter, and Richard L. Hoffman have made separate and successful efforts to collect additional pertinent specimens, and have thereby contributed materially to these notes. I am also indebted to Dr. Doris M. Cochran, Mr. M. Graham Netting, and Mr. James A. Fowler for loaning me comparative material from the collections under their care.

Plethodon richmondi Netting and Mittleman

Bishop (1943: 239) maps the distribution of *richmondi* as exclusive of Virginia, and Grobman (1944: 312) shows a single locality in Virginia based upon a specimen in the Carnegie Museum (No. 18499) collected at Blacksburg in Montgomery County. The following material extends the range eastward well into the Valley and Ridge Province in Virginia and thereby confirms the Blacksburg record. A series of specimens (R.L.H.¹ 10, 11, 48, 99, 155, 469-72, 594-96, 759, 972-73, 990, 992, and 1086) was collected by Richard L. Hoffman in the vicinity of Clifton Forge, Allegheny County. Additional new records include Porters Cave, State Rte. 42, 12 miles northeast of Clifton Forge, Bath Co. (R.L.H. 901); Sizer's Cave, about 4 miles south of Newcastle, State Rte. 42, Craig Co. (R.L.H. 946); Natural Bridge near Buck Hill Cave entrance, Rockbridge Co. (J.A.F. 1051); and vicinity of Warm Springs, Bath Co. (J.A.F. 159). This Virginia material has not been compared with typical *richmondi* in order to evaluate racial variation.

¹Abbreviations used in this paper designate the collections of the following institutions or persons as follows: A.M.N.H., American Museum of Natural History; A.N.S.P., Academy of Natural Sciences of Philadelphia; C.A.S., Chicago Academy of Sciences; C.M., Carnegie Museum; C.N.H.M., Chicago Natural History Museum; D.B.U.F., Department of Biology, University of Florida; J.A.F., James A. Fowler; M.C.Z., Museum of Comparative Zoology; R.L.H., Richard L. Hoffman; S.C.B., Sherman C. Bishop; U.M.M.Z., University of Michigan Museum of Zoology; and U.S.N.M., United States National Museum.



AUG 25 1949

9.
 A. Wetmore

Plethodon wehrlei Fowler and Dunn

In a recent paper (Netting, Green, and Richmond, 1946) records of *wehrlei* in Virginia are discussed. An immature specimen (C.N.H.M. 57029), presumably of this species, was subsequently collected near the side of the road close to the junction of State Rte. 56 and the Blue Ridge Parkway in Nelson County during September, 1946, by Hulda and Arnold Grobman. The records of Netting, Green, and Richmond (1946: 157-60), for Montgomery, Roanoke, and Highland Counties extend the range of *wehrlei* eastward into the Valley and Ridge Province although these contributors are careful to point out that the habitat seems to be continuous from the Appalachian Plateaus into the Valley and Ridge Province. The Nelson County record, if the salamander in question is correctly identified, extends the range eastward into still another physiographic province, the Blue Ridge. I am not able to state, however, whether or not it is possible to trace the habitat continuously between the Nelson County station and the nearest known localities to the west, though I doubt that there is such continuity.

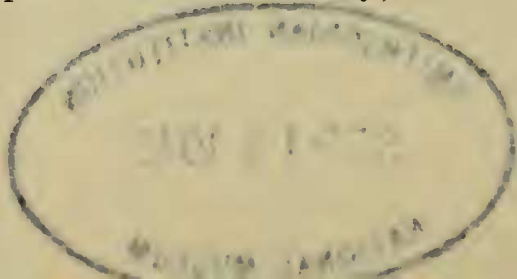
On a trip from Rochester, New York, to Gainesville, Florida, in September of 1946, my wife and I drove along the Skyline Drive in the Shenandoah National Park in Virginia. While along the Drive we stopped to observe casually the salamander fauna with no particular thought of collecting and preserving specimens. At our first stop, however, we came upon a specimen which we thought to be of interest in representing either a considerable range extension of *nettingi* or *welleri* or in being an example of a new form of this group of *Plethodon*. This and additional specimens were saved and subsequent examination suggested that the latter assumption was correct. Additional trips were made to obtain more material; the personnel consisted of: Aug., 1947, Hoffman, Kleinpeter, and myself; Sept., 1947, my wife and myself; Sept., 1947, Kleinpeter and S. A. Peabody; July, 1948, Jopson; and Aug., 1948, Pope and family. A total of thirty specimens of the new form was in this way accumulated. As far as I am aware, the first known specimen of this form was taken by my wife and so it is with great pleasure that I suggest the new form be called:

***Plethodon huldae*, sp. nov.**

Diagnosis—A small flecked *Plethodon* morphologically similar to *Plethodon nettingi* from which it most conspicuously differs in having one more costal groove and a lighter venter.

Holotype—U.S.N.M. 127955, collected along the foot trail to Hawksbill Mountain about 100 yards from the Skyline Drive at an elevation of approximately 3500 feet in Madison County, Virginia in the late morning of September 5, 1947, by Hulda and Arnold Grobman.

Paratypes—All from Virginia. M.C.Z. 26588, Madison Co., 2 miles north of Hawksbill Mt. at spring nearly opposite juncture of foot trail and Skyline Drive, 3350 feet, Sept., 1946, H. and A. Grobman; A.M.N.H. A53996-97, Page Co., near Skyland campsite about ½ mile southwest of Stony Man Mt. and about ¼ mile west of Skyline Drive, 3650 feet, September, 1946, H. and A. Grobman; U.S.N.M. 127956-58, type locality, Aug., 1947, H. I. Kleinpeter and S. A. Peabody; U.M.M.Z. 98748-51,



Madison-Page Co. line, trail to Stony Man Peak from Skyland campsite, 3750 feet, July 18, 1948, H. G. M. Jopson; C.N.H.M. 56501-08, extreme northeast Rockbridge Co., 11.4 miles north of intersection of U. S. Rte. 60 and Blue Ridge Parkway, just above point where Parkway crosses a branch of Nettle Creek, 3150-3300 feet, Aug. 9, 1948, C. H. Pope and family; C.N.H.M. 56509, Roanoke Co., on Poor Mt., a few miles south of Salem, 3400-3600 feet, Aug. 19, 1948, Hallowell Pope; A.N.S.P. 26054 and C.A.S. 14682, Nelson Co., side of road near juncture of State Rte. 56 and Blue Ridge Parkway, 3000 feet, Sept., 1946, H. and A. Grobman; C. M. 28897-99, S.C.B. (3 specimens), and D.B.U.F. 2208-09, type locality, Aug. 7, 1947, Richard Hoffman, H. I. Kleinpeter, and A. Grobman.

Description of the species—*Plethodon huldae* belongs to that group of *Plethodon* that includes *richmondi*, *welleri* and *nettingi*. These are all relatively small salamanders with a dark dorsum flecked in life with green, bronze, gold, silver or brassy, as described by different investigators. (The diversity of these markings may be in their recording rather than in their actual color.) These flecks tend to disappear in preserved specimens within a very short time. Of the three previously described forms, *richmondi* is characterized by a rather elongate body and, associated with it, a high number of costal grooves (20 to 23 as counted by Netting and Mittleman, 1938). At the other extreme of the series is *welleri* with, usually, 16 costals. *P. nettingi* generally has 18, and *huldae*, 19 costals. *P. c. cinereus*, which I do not believe is as closely related to these forms as they are to each other, has a number of costals similar to that of *huldae*. In the accompanying table (Table I) there are listed costal groove counts made by myself within a short period of time and as uniformly as possible.

TABLE I
COSTAL GROOVE COUNTS OF CERTAIN FORMS OF *Plethodon*
AS DESCRIBED IN THE TEXT

Costal Grooves	15	16	17	18	19	20
<i>P. huldae</i>	---	---	---	5	20	5
<i>P. nettingi</i>	---	---	4	20	2	---
<i>P. welleri</i>	2	18	4	---	---	---
<i>P. c. cinereus</i>	---	---	---	15	26	1

The maximum count obtainable was recorded by including a groove over the axilla, whether or not it was well defined so long as there was room for it, and by including all grooves in the region of the groin regardless of any ventral anastomoses or lack of them. Counts were made on both sides of a specimen and recorded separately; occasionally a difference of one groove between the right and left sides of an individual was observed. No attempt was made to force agreement for it was thought that less bias would obtain by permitting occasional errors to be randomized than by subjecting selected individuals to a more detailed study than other specimens received. The *cinereus* studied were specimens taken with the collections of *huldae*. The *nettingi* and *welleri* counts were made on specimens from the Carnegie and U. S. National

Museums. The species of the Welleri Group, arranged in descending order of their costal groove counts, are: *richmondi*, *huldae*, *nettingi* and *welleri*.

P. richmondi, *nettingi* and *huldae* are alike in that the dorsal flecks are relatively discrete; in *welleri* they are frequently coalesced.

The number of vomerine teeth in each series seems to be about the same for each form with an average number of approximately 6.

It is, of course, almost impossible to form a reliable impression of maximum size without an abundance of material. With the information I have available at the present time, it might be said that the size order follows that of the number of costal grooves, but the only fair statements are that *richmondi* is the longest, and *welleri* the shortest, of the four. I do not have figures sufficient to establish that *huldae* is larger than *nettingi* although I suspect that that is the case.

On the specimens I have studied, I find that the number of costal grooves between the toes of adpressed limbs in adults average 5 in *welleri*, 6 in *nettingi* and 7 in *huldae*. (I have chosen to use grooves rather than folds because the former are more discrete and do not require the juggling of fractions the usual method does.) I have restricted these comparisons to adults because of the ontogenetic change that has been demonstrated in this character by Netting and Mittleman (1938: 292), Grobman (1943: 9-11), and others.

Three of the characters discussed above (grooves between adpressed toes, maximum size, and number of costal grooves) are obviously associated and probably do not indicate as much genetic dissimilarity as their listings might suggest. If other recognizable forms within the series are to be expected, the most likely place would be between *huldae* and *richmondi*.

The venter of *huldae* is progressively darker posteriorly. The throat is speckled, the abdomen mottled, and the tail dark. There is a similar, but much less pronounced anterior-posterior pattern gradient in *nettingi*. The throat and anterior abdomen of *huldae* are not matched by *nettingi* but the darker parts are. *P. huldae*, then, has a lighter venter than *nettingi*.

I am indebted to Mr. Pope for the following color description of one of the paratypes (C.N.H.M. 56509) taken in life: "Dorsum: Ground color uniform dark brown, almost black. Moderately profuse silvery flecks over head and back; similar flecks somewhat more profuse on tail except near its tip where they are scarcely visible or lacking. Flecks about as profuse on limbs as on back. Ventrums: Purplish black with profuse irregularly arranged and shaped light areas. Anterior to gular fold, light areas become progressively more profuse until they predominate and finally all but replace the purplish black ones. Lower jaw narrowly bordered with purplish black anteriorly. Soles light colored except for the purplish black webbing. Limbs purplish black except for light creases and a very few light areas like those of the belly. Pattern of ventrum tends to invade lower sides. Eye: Iris black, narrowly bordered with gold above."

Habitat—The great majority of specimens were collected from under rocks, occasionally from under, or in, a log. The sites of collection were high and well forested, usually with a mixed stand of conifers and hardwoods. There was usually plenty of ground cover. *Plethodon c. cinereus*

was found in the same specific areas and seemed to outnumber *huldae* about 3 or 4 to 1.

Physiographic and altitudinal restrictions—All known localities are in the Blue Ridge Province at altitudes between 3000 feet and 3750 feet. The range may therefore be given as above 3000 feet in the Blue Ridge Province in suitable habitats between Poor Mt., Roanoke Co., and Stony Man Mt., Page-Madison Cos.

Identification of *cinereus* and *huldae*—In the general area under discussion *cinereus*, as far as is known, exists exclusively in the red-backed phase. Since *huldae* comes to resemble lead-backed *cinereus* after being in preservative, it may be that there are other specimens of *huldae* in collections that have been identified as *cinereus*. A similar situation existed at the time of the description of *P. richmondi* (Netting and Mittleman, 1938: 287). In the present instance the number of costal grooves will be of no help in segregating the confused specimens.

Relationships in the Welleri Group—The Welleri Group consists of four species as presently outlined. Geographically, *richmondi* is related sympatrically to *nettingi* and perhaps to *huldae*. It is also the largest form with the highest costal groove count and it is suggested (which suggestion is in agreement with that of Green, 1938: 298-99) that a *richmondi*-like animal was ancestral to the other forms in the group. *P. huldae*, *nettingi* and *welleri*, are montane dwarf derivatives with the degree of differentiation being in that order.

Use of the binomial—The most closely related form, morphologically, to *huldae* is *nettingi*; these forms seem to be distinct and could either be considered separate species or "insular" races. The most closely related form, geographically, is *richmondi*; there is, at this writing, no evidence for intergradation between the two. On the basis of present information and current systematic procedure, it seems more reasonable to refer to *huldae* with a binomial than with a trinomial.

Related distributional problems—Further desirable distributional information regarding *P. huldae* includes range extensions to the north; intermediate stations between Poor Mt. and Nelson Co.; and altitudinal range of the form. Collectors in the northern part of the Southern Section of the Blue Ridge between Poor Mt., the southernmost record for *huldae*, and Mt. Rogers, the northernmost record for *welleri* (Hoffman and Kleinpeter, 1948: 107), should search for a flecked *Plethodon*. Intergrades, or an intermediate form, between *welleri* and *huldae* may be anticipated. Pt. Lookout, rising to above 4600 feet, might well be a locality involved.

LITERATURE CITED

- BISHOP, SHERMAN C. 1943. Handbook of Salamanders. Comstock Publ. Co., Ithaca, N. Y. Pp. i-xiv, 1-555. Figs. 1-144. Maps 1-56.
- GREEN, N. BAYARD. 1938. A new salamander, *Plethodon nettingi*, from West Virginia. Ann. Carnegie Mus., XXVII:295-99.
- GROBMAN, ARNOLD B. 1943. Notes on salamanders with the description of a new species of *Cryptobranchus*. Occ. Pap. Mus. Zool. Univ. Mich. No. 470:1-12. Pl. 1. Fig. 1.

- 1944. The distribution of the salamanders of the genus *Plethodon* in eastern United States and Canada. *Ann. N. Y. Acad. Sci.*, XLV, Art. 7:261-316. Figs. 1-11.
- HOFFMAN, RICHARD L. and HUBERT I. KLEINPETER. 1948. A collection of salamanders from Mount Rogers, Virginia. *Journ. Wash. Acad. Sci.*, 38(3):106-108.
- NETTING, M. GRAHAM, N. BAYARD GREEN, and NEIL D. RICHMOND. 1946. The occurrence of Wehrle's salamander, *Plethodon wehrlei* Fowler and Dunn, in Virginia. *Proc. Biol. Soc. Wash.*, 59:157-160.
- NETTING, M. GRAHAM and M. B. MITTLEMAN. 1938. Description of *Plethodon richmondi*, a new salamander from West Virginia and Ohio. *Ann Carnegie Mus.* XXVII:287-293. Pl. XXX.

